

CONFIDENTIAL

CM 2096

Report No.

HBR 3077

1 February 1957

INSTRUMENT DIVISION

This publication, produced by Hycon Mfg. Company, consists of cover and 10 leaves. From the original printing of 27 copies (and one reproducible,) this document is copy 9.

**Description
of**

**MODEL HR-72
CAMERA SYSTEM**

Developed Under Contract No. AF-33 (600) 33725

CONFIDENTIAL

CONFIDENTIAL**TABLE OF CONTENTS****Section 1****HYCON'S LATEST ADVANCE IN
AERIAL RECONNAISSANCE**

Paragraph	Page
1. General	1
2. Significant Advances	1

Section 2**DESCRIPTION**

1. General	1
2. Major Components	1
a. Model 7312 Mount Assembly	1
b. HR-732 Camera	4
(1) Model HL-732 Lens	4
(2) Model HS-731 Shutter	4
(3) Model HM-732 Magazine	4
c. Model 7313 Programmer	4
d. Junction Box	4
e. Remote Controls and Indicators	4
f. Data Correlation	4
3. Leading Particulars	7
4. Additional Features	7

LIST OF ILLUSTRATIONS

Figure	Page
1. Model HR-72 Camera System	2
2. Model 7312 Mount Assembly	3
3. Model HR-732 Camera	5
4. Model HM-732 Magazine	6
5. Model HS-731 Shutter	8

CONFIDENTIAL

CONFIDENTIAL**Section 1****HYCON'S LATEST ADVANCE IN
AERIAL RECONNAISSANCE****1. GENERAL**

Recent successful developments by Hycon in aerial photographic equipment have assured new horizons in aerial reconnaissance. The most up-to-date advances in the photographic field are incorporated in the Model HR-72 Camera System. Its principal design parameter has been maximum intelligence-gathering capability. The equipment features high image quality, maximum film capacity, minimum weight, and high reliability. The equipment is designed for quick installation and removal of the system. This allows for the multiple use of the RF aircraft depending on the mission of the moment. Equally important, it permits maintenance and service of the

sub-system to be independent of any maintenance work on the aircraft, the utilization of which is thereby materially increased.

2. SIGNIFICANT ADVANCES

The following significant advances are incorporated:

Aspheric lens elements for lightweight and high resolution.

Contoured platen for uniformly high resolution. Greater film capacity for increased flight-line miles.

Simplified integral control system.

Unusually favorable camera weight-to-payload ratio.

Lightweight, sturdy IMC mount.

Section 2**DESCRIPTION****1. GENERAL**

The Hycon Model HR-72 Camera System, shown in figure 1, is an automatic, 24-inch focal length, nine-inch by eighteen-inch format, reconnaissance system consisting of three HR-732 cameras in a tri-camera mount. The three cameras are mounted in tandem, and include a right and left oblique and a prime vertical. Total transverse angular coverage of 115 degrees is provided. The unit has a completely self-contained control system and only requires connection to the aircraft 28-volt supply and vacuum source. The design of this equipment is such that it meets the environmental and operational requirements encountered in modern aircraft. Adequate circuitry protection has been provided to prevent damage to the system due to overloads.

2. MAJOR COMPONENTS

The HR-72 Camera System consists of the following separable components: a Model 7312 Mount Assembly,

three HR-732 cameras, and a Model 7313 Programmer. A transportation carriage and a shipping container are provided. Mated ground support equipment is also available.

a. **Model 7312 Mount Assembly.** The mount assembly shown in figure 2 is made up of the following major components: a cradle assembly, mounting plates, an IMC drive assembly and mounting bracket, hinged mounting brackets, and four cradle hoist fittings.

The Model 7312 Mount Assembly is designed to cradle and hold three Model HR-732 cameras. The cameras are secured in a fixed position within the mount assembly cradles in such a manner that the forward unit is at a right oblique angle, the aft unit is at a left oblique angle, and the center unit is mounted vertically along the centerline of the aircraft. Mounting plates, which must be attached to the cameras prior to installation, are a part of the mount assembly and are used when securing the cameras to the sides of the cradles. The mount assembly is attached to the aircraft by means of three

CONFIDENTIAL

CONFIDENTIAL

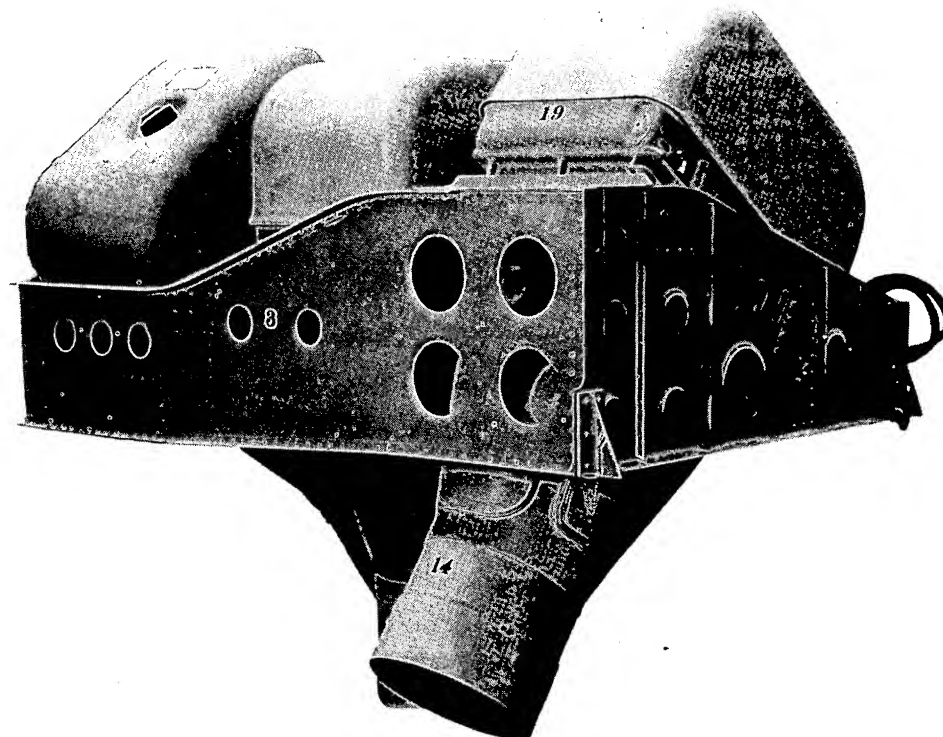
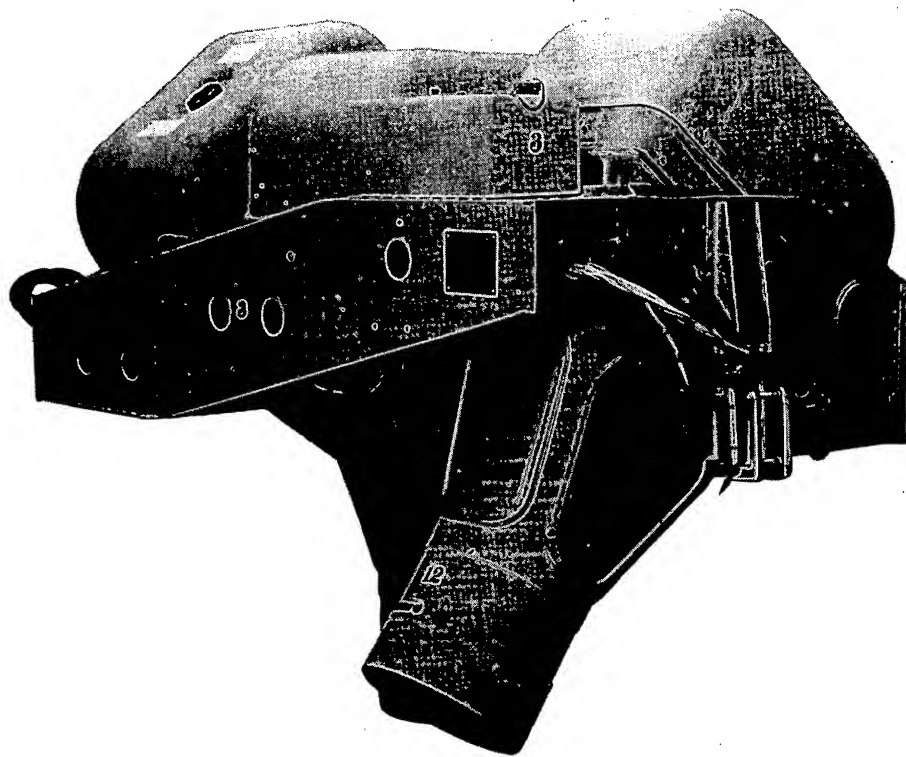


Figure 1. Model HR-72 Camera System

CONFIDENTIAL

CONFIDENTIAL

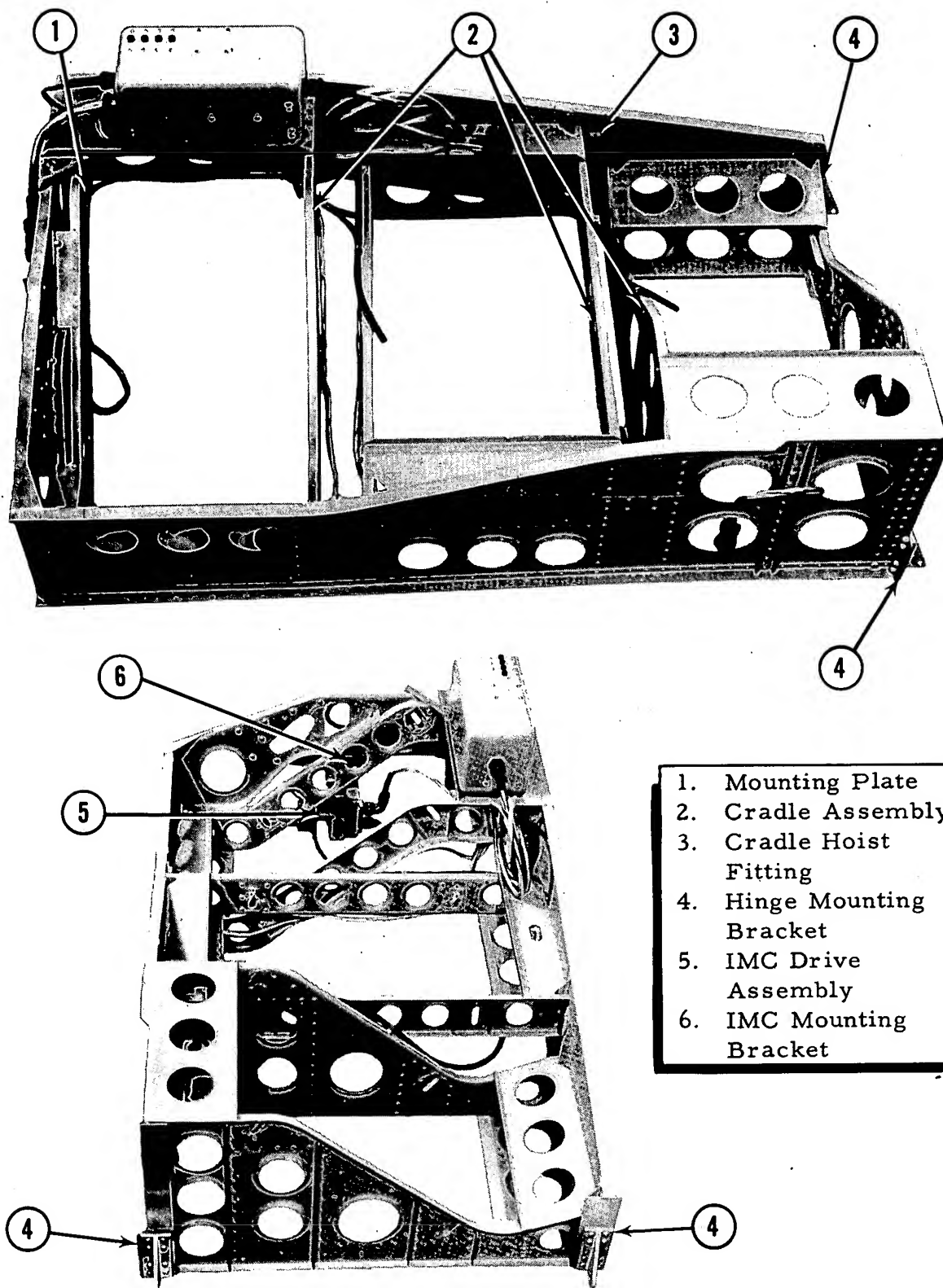


Figure 2. Model 7312 Mount Assembly

CONFIDENTIAL

CONFIDENTIAL

mounting brackets. Two of the brackets are fastened together in such a manner as to form a hinge-type pivoting joint between the mount assembly and the aircraft frame. The remaining mount bracket is located in the center of the forward end of the mount assembly and is secured to the actuating rod of the IMC drive by a roll pin. When a pulse from the intervalometer starts the IMC drive motor, a cam revolves, lowering the front end of the mount assembly and providing IMC for all three cameras.

The mount assembly is of box-girder, riveted-type construction, utilizing extruded frame members and formed panels to provide minimum weight and maximum strength.

b. **HR-732 Camera.** The HR-732 Camera is a 24-inch focal length, nine-inch by eighteen-inch format, lightweight camera. The camera body and lens cone, shown in figure 3, are so designed, manufactured, and assembled as to maintain the complete assembly at minimum allowable tolerances. The camera body and cone are mated and machined as a single unit. The cone and body are integrated and calibrated, thus becoming a permanent assembly. Cone weight is held to a minimum through the use of plastic side panels. A cone extension is furnished and is used to protect the lens during ground handling. The camera body-and-cone assembly contains all the mechanical and electrical components necessary for camera operation, including a time-data recording assembly.

(1) **Model HL-732 Lens.** The lens is a 24-inch, f/8, improved Pentac which utilizes aspheric elements. This design provides extremely high performance with a minimum number of elements. The lens in its mount weighs seven pounds six ounces.

(2) **Model HS-731 Shutter.** The shutter is an intra-lens, high-efficiency type providing effective speeds of 1/125 second and 1/250 second with an efficiency of 65%. Variation in shutter speeds from these values is less than 10% over the range of temperature and other operating conditions to which it is normally subjec-

ted. Means are provided to fix the shutter in the open position for purposes of focusing or calibration. In addition, means are provided for releasing shutter spring tension.

(3) **Model HM-732 Magazine.** The HM-732 Magazine, shown in figure 4, is of lightweight design, accepting a 9½-inch by 1000 foot roll of standard-base film, or an 1800-foot roll of thin-base film. The magazine utilizes new lightweight aluminum spools, and a lightweight fiberglass magazine cover. Means are provided for an automatic cutout so that an overload of the magazine will not damage the film-drive mechanism. A contoured platen is utilized to conform to the surface of best imagery. The maximum depth of contour is 0.1127 inch. An automatic vacuum system is provided to hold the film firmly against the platen during exposure.

c. **Model 7313 Programmer.** The Programmer is an automatic, electro mechanical unit which provides starting pulses or electrical power, as required, for proper sequencing in the operation of the entire configuration.

d. **Junction Box.** The Junction Box contains the circuit breakers for the entire system, an Agastat relay, a fuse block, and the necessary terminal strips. All electrical signals to and from the various components are routed through the Junction Box. The Agastat relay contacts are connected to an indicator light. When the Agastat coil is energized by the shutter circuitry, the indicator light will show that both shutters and film drives are working correctly.

e. **Remote Controls and Indicators.**

1. Off-Standby-Run Switch.
2. Operation Indicator Light.

f. **Data Correlation.** A readily removable data chamber optically records on film the exposure number, time of exposure, mission number, and date.

CONFIDENTIAL

CONFIDENTIAL

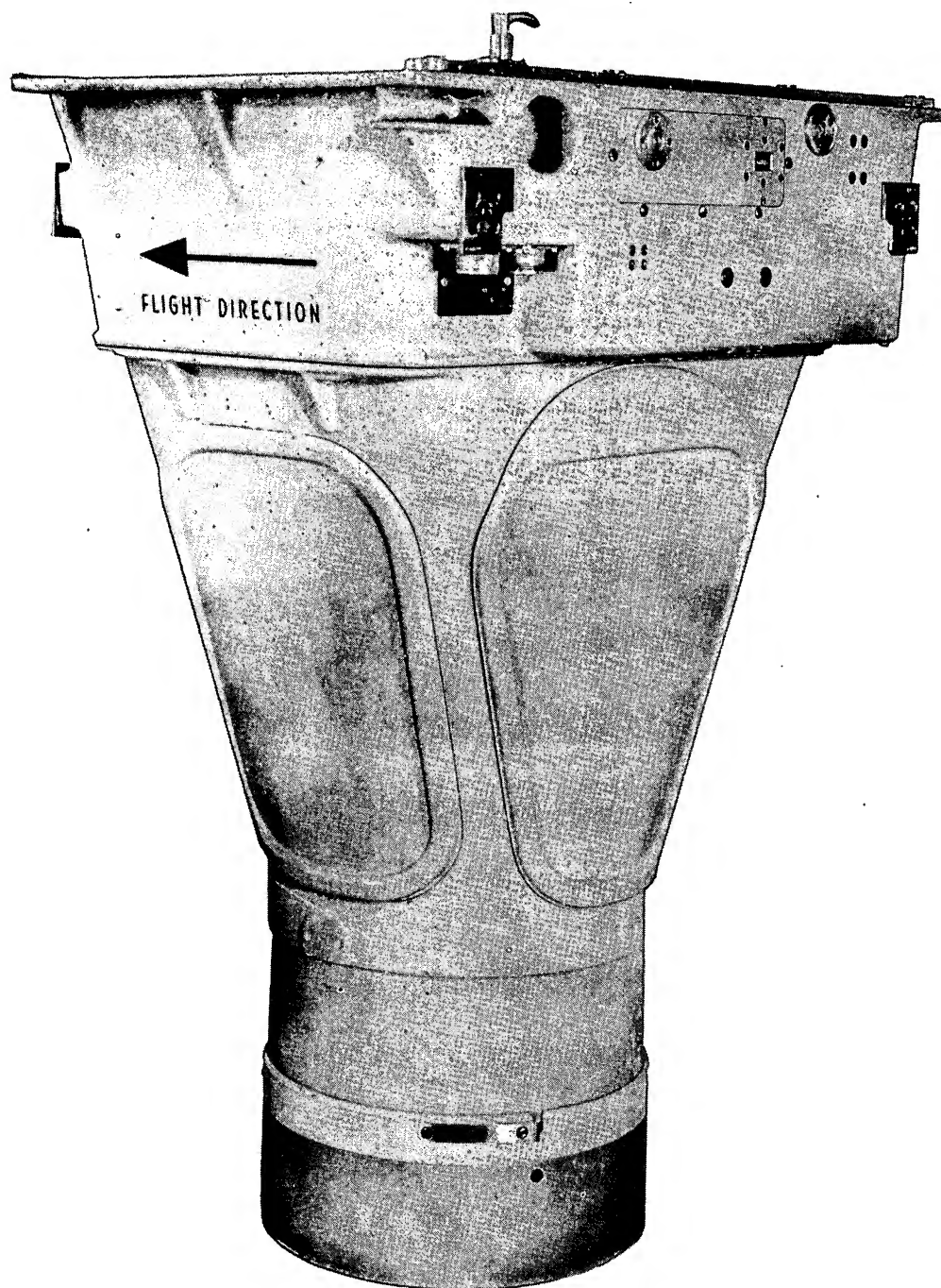


Figure 3. Camera Body and Lens Cone

CONFIDENTIAL

CONFIDENTIAL



Figure 4. Model HM-732 Magazine

CONFIDENTIAL

CONFIDENTIAL**3. LEADING PARTICULARS**

- a. In-Flight System
Resolution 33 lines/mm
- b. Over-all Dimensions,
HR-72 Configuration.
Length 53.60 inches
Width 36.25 inches
Height 42.25 inches
- c. Over-all Dimensions,
HR-732 Camera.
Length 22.375 inches
Width 14.375 inches
Height 40 inches
- d. Over-all Dimensions,
Shipping and Storage
Container.
Length 70.25 inches
Width 50.75 inches
Height 64.875 inches
- e. Weight, HR-72
Configuration.
Full operational
condition (normal
film load) 366 pounds
- f. Weight, HR-732
Camera.
Complete 63 pounds
- g. Component Weight.
Camera body includ-
ing lens cone and
shutter assembly . . 38 pounds
Magazine 25 pounds
- h. Film Spool Capacity
(Each) 9 1/2 inches wide. Up to
1,000 feet standard-base.
Up to 1800 feet thin-base.
- i. Format (HR-732
Camera) 9 inches x 18 inches
- j. Power Requirements
(HR-72 Configuration) . 27.5 volts d-c
15 amps (average)
- k. Film Velocity
(HR-732 Camera) . 7.4 inches
(average)

- l. Shutter Speeds
Available.
(Effective exposure
time) 1/125, 1/250 second
- m. Aperture Stops . . f/8 to f/16
- n. HR-732 Camera
Positions (Triple
Mount).
Number of right
oblique positions . . 1
Number of vertical
positions 1
Number of left
oblique positions . . 1
Total angular
coverage 115 degrees
Distance between
positions 37 degrees
Angular overlap . . 4 degrees 8 minutes
- o. IMC Drive.
Action Mount rests in position
tilted up at forward end.
IMC lowers forward end of
mount to level position.
IMC commences one-half
second before shutter fires.
Mount lowers in one second
and raises in one second.
IMC cam fires shutter. IMC
returns mount to rest
position.
Total travel 0.347 inch.

4. ADDITIONAL FEATURES

The Hycon Model HR-72 Camera System is adaptable to a variety of other applications. The following modifications to the basic configuration have been designed or are contemplated, depending upon application.

- a. Variable IMC to maximum rate of 0.101 radian/sec.
- b. Maximum cycling rate of 1 1/2 seconds per frame.
- c. Adaptation of HS-732 shutter, a drawer-type shutter of large aperture and high reliability now in use in a different application. (See figure 5.)
- d. Adaptation of FTL photo-head for digital recording data.

CONFIDENTIAL

CONFIDENTIAL

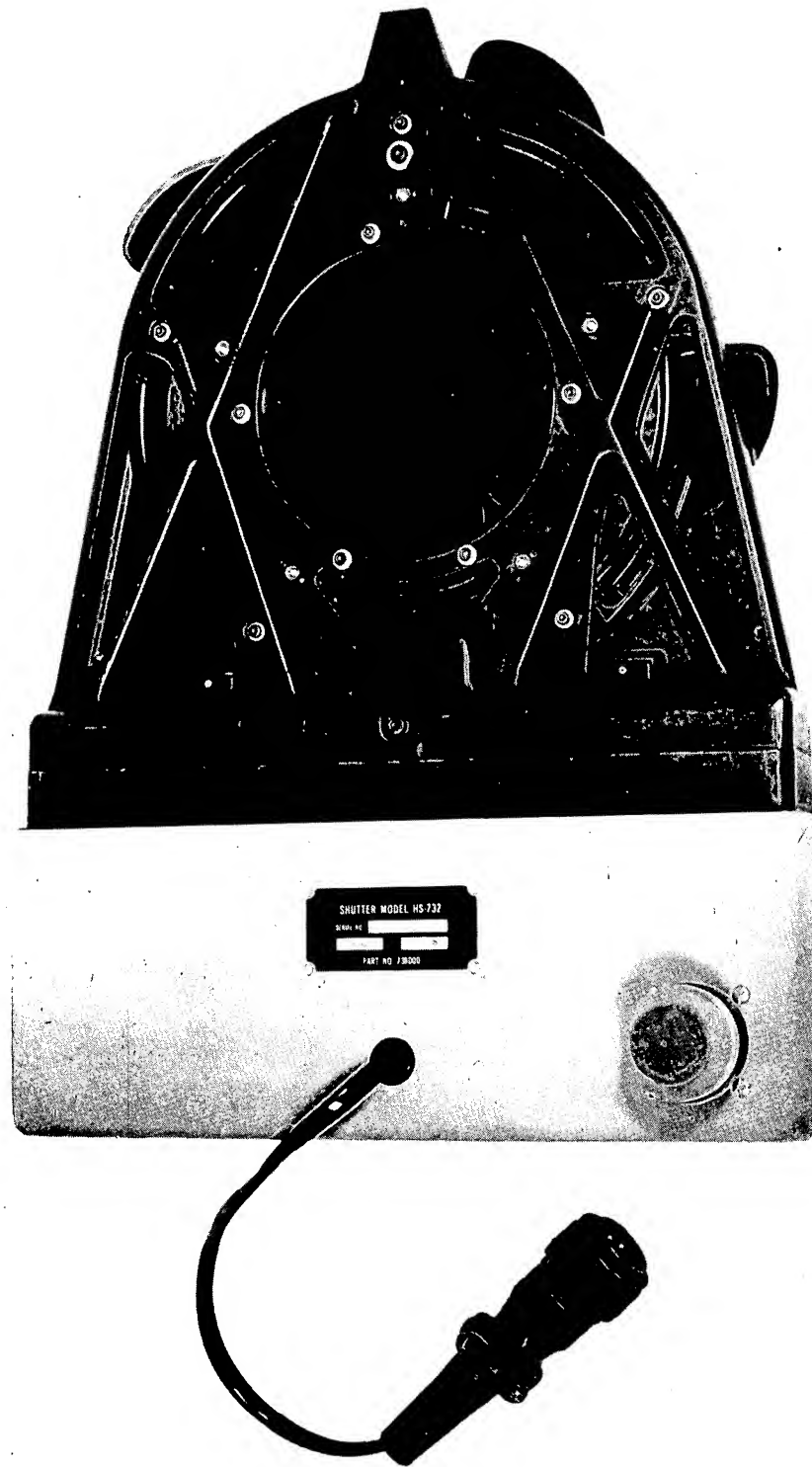


Figure 5. Model HS-732 Shutter

CONFIDENTIAL